## Chapter 4

# Air Movement Operations

Air travel is the only transportation method that meets world situations requiring immediate response. Air movement of units requires planning at all command levels. Units must be trained to skillfully execute an air deployment. This chapter provides a brief overview of missions, responsibilities, and general instructions for conducting strategic air movement. FM 55-9 and FM 55-12 provide detailed guidance for air movement planning and loading procedures.

## TYPES OF AIR MOVEMENTS

4-1. There are two types of air movement (nontactical [administrative] and tactical [combat]). Army units plan for nontactical movements unless they are conducting forced entry operations.

### NONTACTICAL MOVEMENT

4-2. A nontactical movement is a movement of troops and equipment that is organized, loaded, and transported to expedite movement and conserve time and energy when no enemy interference is anticipated. It emphasizes economical use of the aircraft cabin space and maximum use of the ACL. The ACL is the amount of cargo and passengers (as determined by weight, cubic displacement, and distance to be flown) that may be transported by a specific type of aircraft. Unit integrity or off-loading sequence is second in priority to load efficiency when planning a nontactical movement.

### TACTICAL MOVEMENT

4-3. A tactical movement is a movement of troops and equipment that is organized, loaded, and transported to facilitate accomplishment of a tactical mission. The arrangement of personnel, equipment, and supplies is designed to conform to the anticipated tactical operation of the unit. Proper use of the aircraft ACL is still an important factor, but the commander's sequence of employment has priority.

## AIR FORCE AIRLIFT AIRCRAFT

4-4. Deployment planners must be familiar with the types of available aircraft and their characteristics. The aircraft of primary concern are the C-141, C-5, C-17, and KC-10. The C-130 may be used for strategic movement, but it is normally used in a theater role. The cargo compartments may be configured to accommodate unit vehicles, palletized cargo, and troops. The wide range of cargo carried by these aircraft, along with the many combinations of loads, provides great flexibility in moving troops and equipment.

## AIRCRAFT CHARACTERISTICS

4-5. If a complete file of Air Force publications is not available, the unit's affiliated AMC AMCS will assist the unit load planners. The AMCS is an extension of the unit's staff for all airlift planning. Important aircraft characteristics include the following:

- The size of the cargo door and its location and height above the ground.
- The size and shape of the cargo compartment.
- The strength of the aircraft floor.
- The seating configuration available for airlifting troops.

**C-130**

4-6. The C-130 Hercules is a four-engine, turbo-prop, medium-range assault transport airplane. Its short field capability makes it suitable for tactical and theater air transport. Figure 4-1, page 4-2, shows the aircraft's characteristics.

**C-141**

4-7. The C-141 Starlifter is a high-wing, four-engine, turbofan, heavy-transport airplane. Used mainly in a strategic role, it is the core aircraft used for basic air movement planning. Cargo area dimensions are for general planning purposes only. Figure 4-2, page 4-2, shows the aircraft's characteristics.

**C-5**

4-8. The C-5 Galaxy is a high-wing, four-engine, turbofan, heavy-transport airplane. It is used mainly in a strategic role to airlift cargo considered outsized to the C-141. Unique features of this aircraft are the forward cargo door (visor) and ramp, the aft cargo door system and ramp, and a separate passenger compartment. These features allow drive-on/drive-off loading and unloading. Figure 4-3 (page 4-3), shows the aircraft's characteristics.

**C-17**

4-9. The C-17 Globemaster III is a high-wing, four-engine, turbofan, heavy transport airplane scheduled to replace the C-141 in its role as the core strategic airlift asset. The C-17 has approximately the same wingspan as the C-141 but can carry twice the payload. It can deliver the same outsize equipment as the C-5 into small airfields previously restricted to the C-130. This ability to land on short runways with anticipated payloads up to 169,000 pounds enables delivery of equipment directly to short airfields without intermediate transshipment. Figure 4-4 (page 4-3) shows the aircraft's characteristics.

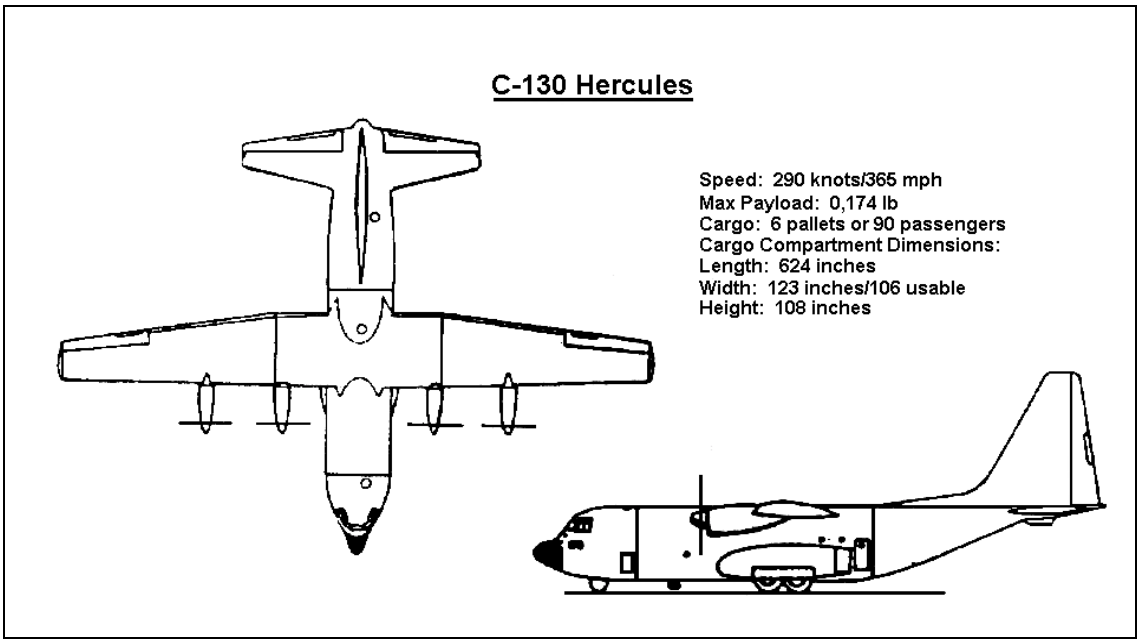


**Figure 4-1. C-130 Aircraft Characteristics**

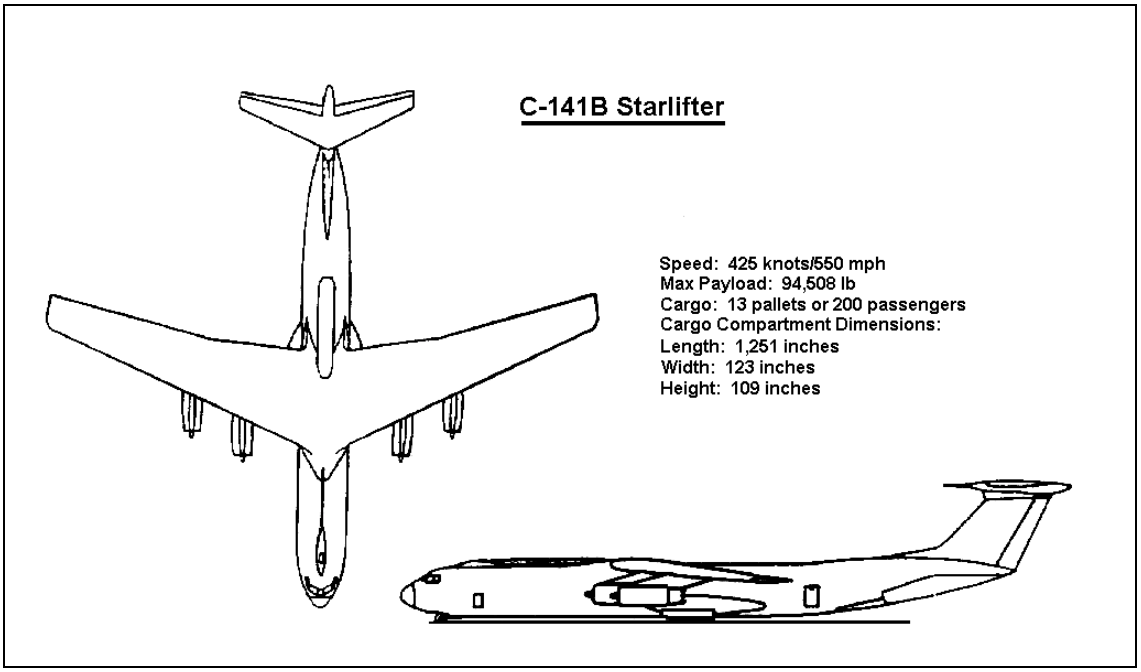


**Figure 4-2. C-141 Aircraft Characteristics**

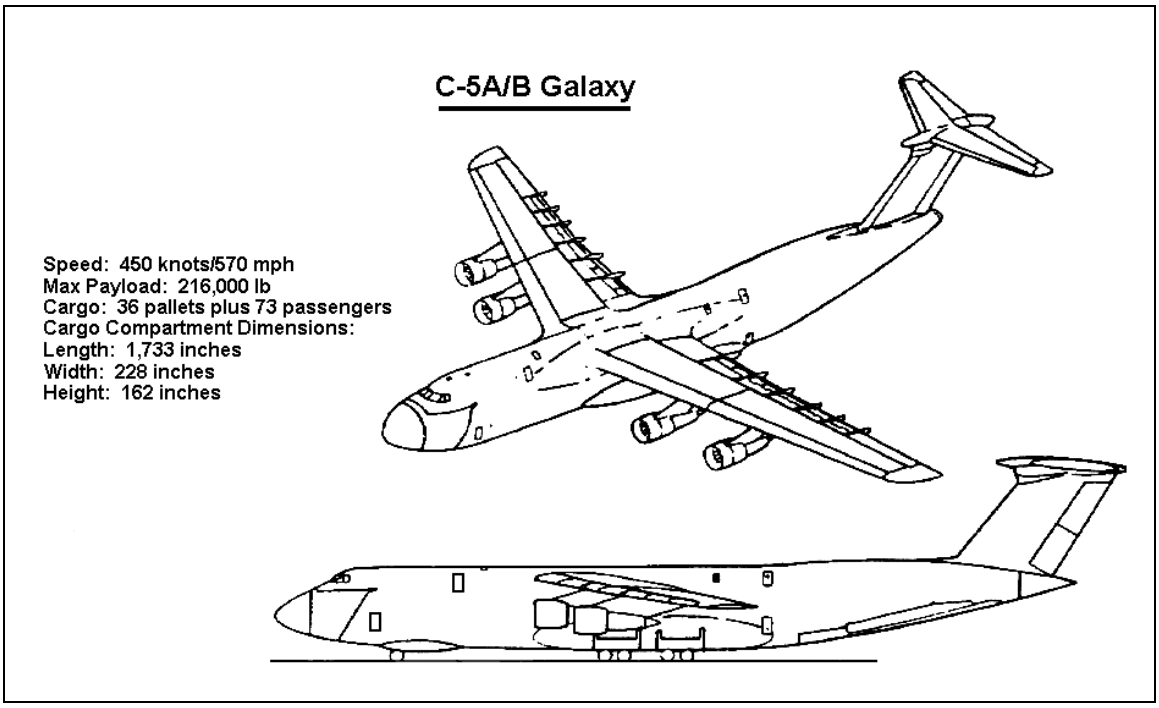


**Figure 4-3. C-5 Aircraft Characteristics**

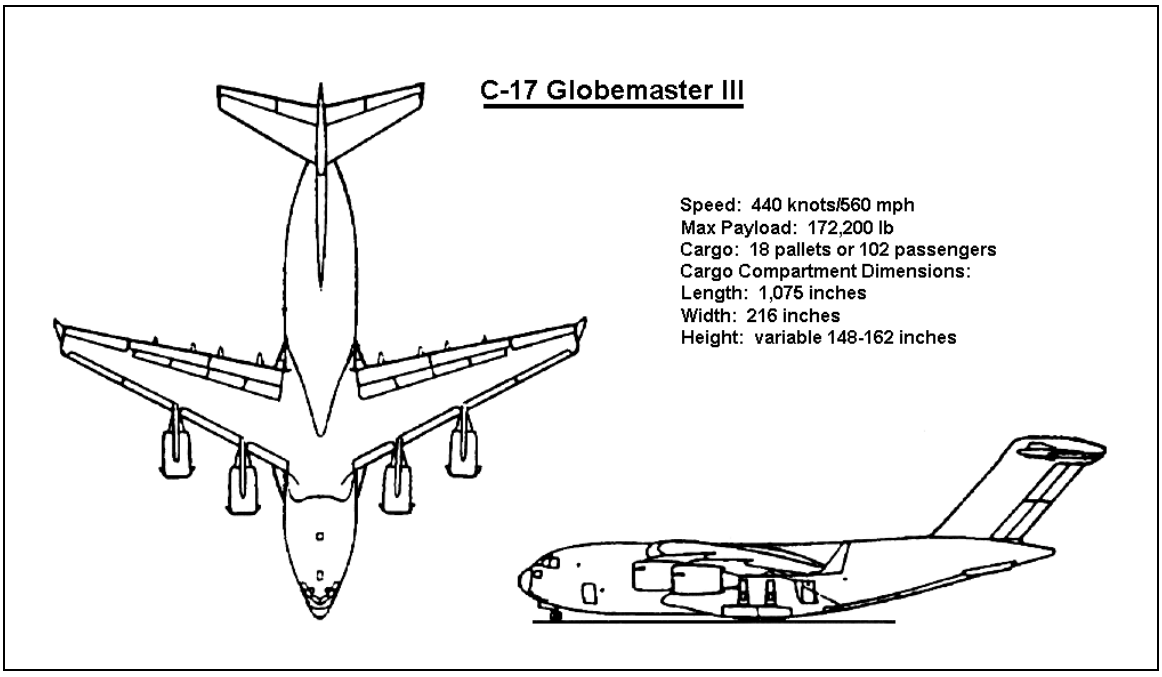


**Figure 4-4. C-17 Aircraft Characteristics**

**KC-10**

4-10. The KC-10 Extender is a swept-wing, wide-body, tri-jet with a dual purpose mission as an aerial refueler and cargo/passenger aircraft. Unit personnel, equipment, and materiel are carried on the upper deck, and fuel tanks are contained in the lower compartments of the fuselage. The unique loading requirements and limitations for the KC-10 require special equipment and attention. This aircraft does not have a ramp at ground level and requires the use of a wide-body elevating loader. Figure 4-5 shows the aircraft's characteristics.

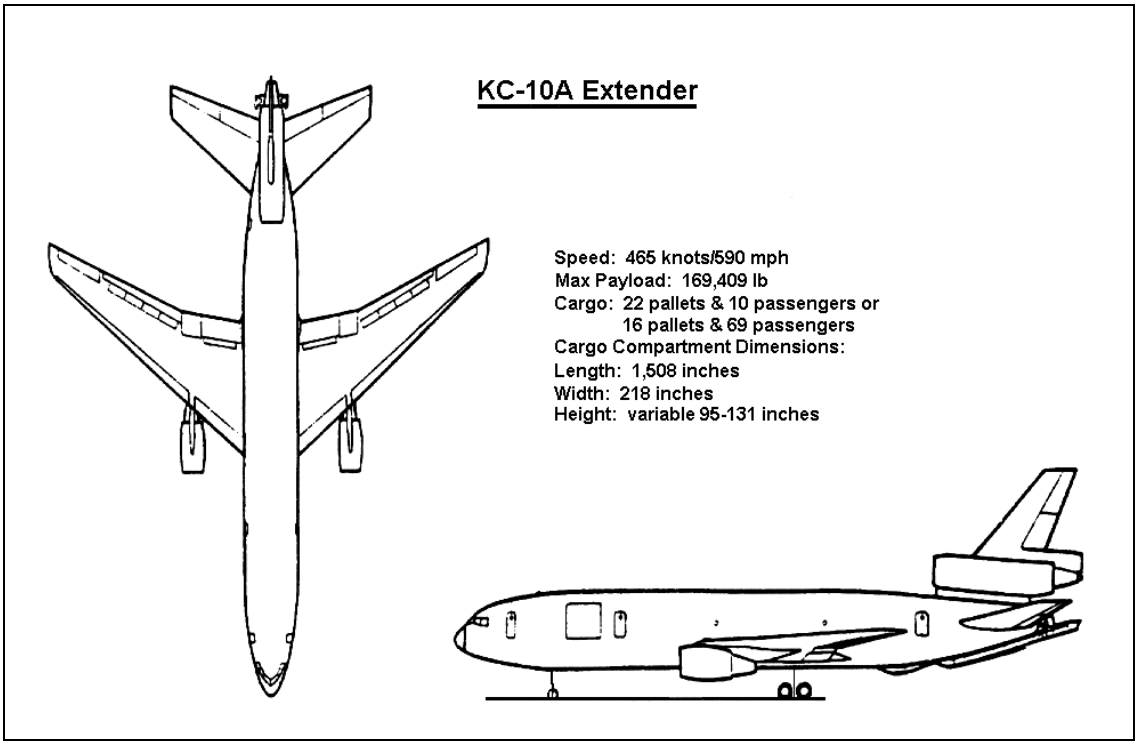


**Figure 4-5. KC-10 Aircraft Characteristics**

## CIVIL RESERVE AIR FLEET AIRCRAFT

4-11. In a national emergency, military airlift may be in short supply. CRAF is a program that employs the aircraft and support capability of US civil air carriers to rapidly augment organic military airlift forces during periods of increased airlift activity. During deployment, many units will use civilian aircraft to deploy most of the personnel and some unit equipment. Air Force aircraft will be used to carry large vehicles and equipment. CRAF is activated in three stages to provide AMC with the flexibility to tailor the airlift force to meet the needs of various degrees of airlift shortfall. The three stages are as follows:

- Stage I is activated by the CINC USTRANSCOM to provide responsive support during a committed expansion of airlift capability. Peacetime procedures remain in effect. This stage is only an expansion of airlift capability contractually committed to call-up. Carriers have 24 hours to make aircraft available for missions.
- Stage II is activated by CINC USTRANSCOM upon approval of the SECDEF. It provides additional airlift to support an airlift emergency. This stage increases the capability more than Stage I without resorting to full mobilization. Carriers have 24 hours to make aircraft available.
- Stage III provides the total CRAF capability for major military emergencies warranting a full mobilization of US forces. The CINC USTRANSCOM issues the order to activate CRAF Stage III only after the President or Congress declares a national emergency. Carriers have 48 hours to make aircraft available.

4-12. Deployments with CRAF aircraft require considerations not usually encountered in loading military aircraft. The cargo compartment of a B-747, for example, is 16 feet AGL. Standard military MHE cannot load the aircraft.

4-13. Unlike standardized military cargo aircraft, civilian airframes vary widely. It is not uncommon for the same type, model, and series of civil aircraft to vary greatly depending on the carrier's needs. All CRAF aircraft will need some modification before military vehicles and equipment can be loaded and transported on them. The deploying force may have to install a 463L pallet subfloor before loading vehicles. Even then, any vehicle heavier than a 2 1/2-ton truck cannot be loaded onto most civilian aircraft.

4-14. The roller/restraint systems in most civilian aircraft will accept a military 463L pallet with some modification. Weight and height restrictions are also critical. Differences in fuselage configurations will cause pallet load heights to vary, especially in the lower lobes of wide body aircraft. More in-depth guidance on type, model, and series capabilities is contained in AMCP 55-41 and FM 55-9. The servicing AMCS can provide assistance.

## THE 463L CARGO SYSTEM

4-15. The 463L cargo system includes the pallets, nets, MHE, and aircraft rails and roller system. The overall dimensions of the 463L pallet is 88 X 108 inches. The usable dimensions are 84 X 104 inches. This allows two inches around the load to attach straps, nets, or other restraint devices. An empty 463L pallet weighs 290 pounds and 355 pounds with nets.

4-16. The rails and roller system consists of rows of rollers and rails that allow the palletized cargo to easily move into the aircraft. Supplies and equipment are placed on 463L cargo pallets and secured with cargo restraining nets. The three standard nets of the 463L pallet system will restrain up to 10,000 pounds of general cargo, 96 inches high.

4-17. The 463L pallet may be used as a mobility platform for other than general cargo weighing more than 10,000 pounds. Palletized loads over 10,000 pounds must be restrained with chains and devices to the aircraft floor, the pallet rings, or restraint rail tie-down rings. Palletized loads exceeding 10,000 pounds requires coordination with AMC.

4-18. Pallets are available to units planning or executing an air movement through their ITO/ICUMO from AMC. The user is responsible for building 463L pallets and may be responsible for loading them onto aircraft. FM 55-9 provides detailed guidance on pallet building and documentation.

## UNIT AIR MOVEMENT PLANNING

4-19. Air movement planning is a critical skill that requires training and experience. The challenge is to determine the number and types of aircraft required to support the movement mission.

4-20. The first step in air movement planning is to determine whether the movement is tactical or nontactical. This depends on the unit's mission upon arrival in the theater. The mission may drive the type of aircraft allocated for the movement. The next step is to determine what will move by air, the type of aircraft anticipated, commander's guidance, the unit's movement priority, and the priority of movement for personnel and equipment within the unit. Based on this information, the planner can determine and request the number of sorties by type of aircraft required to complete the mission. For nontactical movements, aircraft must be used to their maximum capability based upon applicable ACL and available passenger seats.

4-21. Plan vehicle loads with as much unit equipment as possible up to the load capacity of the vehicle. To ensure accurate movement planning figures, measure and weigh the vehicles planned for each load. FM 55-12 provides guidance for weighing and marking the vehicles.

4-22. Aircraft are requested based on DD Form 2327. This form requires weight and dimension data, to include the cargo weight of the vehicles carrying cargo. Each aircraft load requires a cargo manifest. Use DD Forms 2130-series (depending on the type of aircraft being used) or automated planning systems (CALM/ALM) to plan the placement of each vehicle and item of equipment. Refer to FM 55-12 for guidance on completing the manual forms. See AFM 28-346 for more information on CALM.

4-23. Two methods of determining aircraft (sortie) requirements are the weight and type load methods. These methods are described as follows:

- Use the weight method to calculate sortie requirements to transport large amounts of vehicles, general cargo, and personnel. This method is based on the assumption that total weight, not volume, is the determining factor. MACOM level planners normally use this method to quickly approximate airlift requirements.
- Use the type load method to calculate individual sortie requirements for like loads. In most unit air movements, a number of the aircraft loads can contain the same items of equipment and number of personnel. Preparing identical type loads greatly simplifies planning and makes manifesting easier. This method is normally used by unit level planners.

## AIRCRAFT LOAD PLANNING

4-24. Air load planning is a critical skill that requires training and certification. Units that plan to deploy by air must have certified air load planners to develop viable air load plans. The load planner must perform the following:

- Ensure the safe and efficient use of the aircraft.
- Comply with aircraft safety, weight and balance, and floor load restrictions.
- Ensure that the load is within an acceptable CB condition for takeoff, flight, and landing.
- Coordinate loading with the aircraft loadmaster.

The load planner must also keep other factors in mind such as ease of on load and off load. Improper planning can result in excessive loading or off loading time or structural failure in flight or on landing. A load properly planned and coordinated will go on the aircraft quickly, safely, and with minimum difficulty.

### MANIFESTING

4-25. During manifesting, load planners complete the final load plan and cargo manifests. The final load plans may differ from the preplanned ones due to changes in unit movement priorities, aircraft scheduling, or equipment due to breakage in the marshaling yard. The planner identifies the unit equipment and passengers for each aircraft. Final manifesting with actual weights at the airfield is normally completed with automated systems. However, planners must be prepared to use manual systems (templates on DD Form 2130-series) when automation is not available. See FM 55-12 for further guidance.

**TYPES OF LOADS**

4-26. The two basic types of loads are concentrated loads and palletized loads. These loads are described as follows:

- A concentrated load is a very large or heavy item, such as vehicles, tanks, or construction equipment. Planners must compute the precise station location on which the item is to be placed inside the aircraft and determine and mark the CB. Since station computations enter into this method of loading, it is also called station loading.
- A palletized load consists of 463L pallets. The center of each pallet is its CB unless otherwise marked. The 463L restraint rail system positions and secures the pallets in the aircraft. Army units build their own 463L pallet loads. They must identify 463L pallet requirements so the Air Force can properly prepare the aircraft.

**GENERAL RULES**

4-27. General rules of loading apply to all aircraft. These rules are as follows:

- Plan to move general bulk cargo, such as boxes or crates, on the back of cargo carrying trucks or trailers.
- When loading cargo in the beds of trucks or in trailers, do not exceed the rated capacity of the vehicle.
- When loading 463L pallets, use forklifts rated at a lifting capacity equal to or greater than the pallet weight. Normally, 10K AT and/or RT forklifts are used.
- Identify in advance any additional required loading aids to ensure availability at the equipment load time. Examples are shoring, aircraft winch, and MHE. (Aircraft ground time is minimized when the unit is prepared to load.)
- Use shoring to prevent damage to the aircraft floor or airfield pavement.
- Do not deflate vehicle tires to achieve vehicle height clearance to fit within the aircraft loading envelope.
- Do not use the book weight of items for weight and balance purposes when the actual airlift occurs. Use the actual scale weight.
- Do not exceed the aircraft limitations specified in FM 55-9.
- Plan on a driver and assistant driver to accompany each vehicle.
- Keep the associated trailer connected to its prime mover for ease of off-load.

Although the load planner knows the general rules for planning aircraft loading, there are other considerations when loading the C-130, C-141, and C-17. None of these aircraft has a separate troop compartment; therefore, when planning troop movements, cargo carrying capacity is sacrificed. Cargo loads restrict the number of troops that can be carried.

## LOAD PLANNING FACTORS

4-28. Many factors must be considered in the load planning process. Among these are the allowable cabin load, cargo weight and CB, and aircraft cargo load CB.

### ALLOWABLE CABIN LOAD

4-29. The load planner must know the ACL for a particular aircraft. ACL is the weight of cargo and personnel that an aircraft can carry. Air Force personnel provide the ACL for each operation. Several varying factors determine the ACL such as, the critical leg of the route and departure and arrival airfield characteristics. The ACLs shown in Table 4-1 are based on a 3,200 NM range and are for general planning purposes only.

**Table 4-1. Allowable Cabin Loads**

| | |
|---|---|
| C-130E/H | 25,000 pounds* |
| C-141B | 46,000 pounds |
| KC-10 | 80,000 pounds |
| C-5 | 130,000 pounds |
| C-17 | 90,000 pounds |
| | |
| *The C-130 ACL is not based on 3,200 NM range. | |
| | |
| NOTE: Actual planning ACLs for each aircraft may be obtained from the unit's affiliated AMC airlift control squadron. Based on the mission, accurate ACL information can only be obtained from known operating conditions. | |

### CARGO WEIGHT AND CB

4-30. The transported unit is responsible for weighing and marking the cargo CB for air movement. The cargo weight and CB must be determined to accurately compute the weight and balance condition of a loaded aircraft. Every piece of cargo must be weighed. Every item measuring 10 feet or longer or having a balance point other than the center must be marked with its CB.

4-31. Weigh and mark all vehicles (without driver) after secondary cargo has been loaded and secured. Weigh and mark prime movers and trailers as they will be loaded on the aircraft (connected or disconnected). The CB is not normally marked on pallets. Once the weight and CB are determined, nothing can be added or moved without reweighing and remarking the cargo. See FM 55-12 for detailed procedures on weighing and marking cargo.

### AIRCRAFT CARGO LOAD CB

4-32. Since balance of the aircraft is mainly affected by weight variations along the longitudinal axis of the cargo inside the aircraft, the term CB refers to the balance point of items of cargo or equipment that go into the aircraft. Each aircraft has a CB range. All aircraft loads must have a CB within the range of the specific aircraft. Compute the total load weight and CB to ensure that the limits of the aircraft are not exceeded. To do this, you need to know the following:

- Weight of each vehicle or piece of cargo.
- Fuselage station CB of each vehicle or piece of cargo as it is located within an aircraft.
- Total cargo CB limitations range of the aircraft.

Refer to FM 55-9 and FM 55-12 for aircraft cargo load CB computations.

## AIR TERMINALS

4-33. Air terminal operations occur at military and civilian air fields. The air terminal commander or civilian operator is responsible for air terminal operations. The Army or other service component commander will provide an A/DACG to control Army activities at the terminal. The A/DACG may also be responsible for loading and unloading aircraft and cargo at these facilities. Deploying units coordinate with the A/DACG for their responsibilities in processing through the terminal. The Air Force TALCE supervises Air Force operations at the air terminal. The A/DACG and the TALCE must coordinate support responsibilities prior to the start of operations. See Chapter 7 for departure air terminal operations and Chapter 8 for arrival air terminal operations.

## AIRCRAFT LOADING GUIDANCE

4-34. A variety of techniques can be used to load aircraft. Aircraft are usually loaded according to the unit's load plans. However, the aircraft loadmaster is the final authority on how cargo is to be loaded and positioned aboard an aircraft. The DACG normally does the loading under the supervision of the loadmaster.

### LOADING TECHNIQUES

4-35. The basic techniques for loading are described below.

**Drive-on/Drive-off.** The vehicle or prime mover is driven or backed under its own power into the aircraft cargo compartment. This method is generally the easiest for loading vehicles and is also used for vehicles with towed loads and for tractor-trailer units.

**Towed or Pushed Loads.** Certain loads, such as trailers, must be towed or backed aboard the aircraft either by a prime mover or pusher vehicle. A pusher vehicle equipped with a front-mounted pintle hook is particularly helpful in pushing large trailers aboard the aircraft because the driver can more easily control the operation. If the towed load remains with the prime mover aboard the aircraft, the trailer may or may not remain hitched to the prime mover inside the aircraft. The loadmaster may direct that the trailer be uncoupled. In that case, the tongue is normally lowered on the aircraft floor under the prime mover. Semitrailers may not be disconnected. Ensure that proper shoring is placed under the tongue to prevent metal-to-metal damage to the aircraft floor.

**Winched Loads.** It may be necessary to winch wheeled or tracked vehicles, helicopters, and palletized cargo into the aircraft. This method is very useful where cargo compartment clearances and ramp inclines are difficult to negotiate. The winch may also be used to unload cargo or vehicles to control movement down the ramp.

**Direct Loading From Vehicles.** In this method, a vehicle delivers cargo directly to the aircraft. The vehicle is positioned close to the aircraft ramp or door, permitting direct transfer of the cargo from the vehicle to the aircraft cargo compartment.

## SHORING

4-36. Some items loaded on aircraft require shoring. The moving unit provides this shoring when required. Shoring is made of lumber, planking, or similar material. Shoring does the following:

- Protects the aircraft cargo floor or 463L pallet surfaces.
- Decreases the approach angle of aircraft ramps.
- Protects airport parking ramps.
- Spreads weight over a larger area.

The requirement for shoring is based on the type of aircraft. Units obtain shoring through their DPW or area command. Units should save shoring for redeployment. The affiliated AMCS an provide technical guidance on shoring requirements and dimensions. FM 55-9 provides additional information on the types of shoring and their uses.

4-37. When shoring is required to load cargo, it will also be needed to unload. If shoring is not available at the destination, then the shoring must be transported with the load. Include the weight of the shoring with the weight of the cargo. For tracked vehicles, simply load the lumber on top of the vehicle while it is being weighed. For rough terrain forklifts or other pieces of equipment that require sleeper shoring, weigh the shoring separately and add the weight to the vehicle weight.

### CARGO RESTRAINTS

4-38. Cargo must be restrained (tied down) in an aircraft so that it remains stationary in the cargo compartment when the aircraft is subjected to turbulence, vibration, acceleration, deceleration, and landings. Restrain cargo with tie-down devices provided aboard the aircraft. FM 55-9 gives detailed instructions on how to restrain cargo.

## SAFETY

4-39. Safety is a very important consideration in any airlift movement to prevent injury to personnel and damage to equipment. Safety is the result of effective training, common sense, and alertness. Leaders at all levels are responsible for evaluating the risk of each phase of every air movement operation. Hearing protection will be used as needed during all air movement operations. FM 55-9 covers specific safety measures for vehicle operations during aircraft loading.

### FLIGHT LINE SAFETY

4-40. Personnel on the flight line will observe the following:

- Will not smoke on the aircraft parking ramp area or flight line.
- Will not walk in front of any aircraft when the engines are running. Personnel must never walk within the propeller arc.
- Will observe a 15 mph speed limit for all vehicles on the flight line, a 5 mph speed limit for all vehicles within 25 feet of an aircraft, and a 3 mph (walking speed) when within 10 feet of the aircraft.
- Will not approach within 50 feet of an engine intake or within 200 feet of the blast area to the rear when jet engines are running. On propeller-driven aircraft, the danger area is 10 feet in front of the propeller and 200 feet to the rear.
- Will not drive vehicles under any part of the aircraft.
- Will not drive or park vehicles, except those being loaded or off-loaded, within 10 feet of an aircraft without a walking guide to observe clearance between vehicle and aircraft.
- Will approach an aircraft in a vehicle with the driver's side nearest the aircraft. Personnel will park the vehicle parallel to the aircraft wings.
- Will not allow trash or debris to be thrown on the flight line. Personnel will also ensure that canvas or small pieces of equipment are secure to prevent the jet exhaust from blowing them around.

- Will not back vehicles toward or into an aircraft without spotters placed at the front and rear corners of the vehicle. Spotters should not be directly in front of or behind any moving vehicle. The aircraft loadmaster directs all backing. Vehicles backing toward aircraft cargo doors, other than the vehicle loading ramp, should have a chalk block placed between the vehicle and the aircraft at a position to stop the vehicle before it could strike the aircraft.
- Will not allow troop formations on the flight line without Air Force or D/AACG escort. Troops move on the airfield in controlled formation only; halt at least 100 feet from the edge of runways, taxi strips, and ramps; and get clearance before crossing. Units will not hold standing formations on the flight line.

**IN-FLIGHT SAFETY**

4-41. While in flight, personnel will follow instructions of the aircraft commander and observe the following:

- Will keep seat belts fastened when taking off or landing and when ordered by the aircraft commander.
- Will not smoke.
- Will not operate electronic devices.
- Will follow the instructions of the aircraft commander or designated representative in the event of an emergency.

**OFF LOAD SAFETY**

4-42. When deplaning or off loading, personnel will observe the following:

- Will not remove any restraint devices or start vehicles until instructed by the aircraft loadmaster.
- Will exit the aircraft on direction of the aircraft loadmaster and ground guides.
- Will have vehicles proceed directly aft of the aircraft at least 25 feet before making any turns.